Dewatering is accomplished on 4 two-meter Ashbrook-Simon-Hartley belt filter presses. The belt presses were started up on CV 5240H and CV 3650 at varying concentrations. The most economical dewatered sludge was made with a 60:40 blend of CV 5140H with CV 3650, respectively. This operation reduced plant operating costs by approximately 20%, obtaining in excess of 24% sludge cake solids. Other polyacrylamides are unable to even obtain 18% cake solids at any dosage.

EXAMPLE 9

A jar test was performed utilizing a 1 gallon plastic container. Sludge was obtained from the thermophillic process at College Station, Tex. In this test, aluminum sulfate, ferric chloride and blends of aluminum sulfate and ferric chloride were evaluated with CV 3650 in combination with CV 5135D.

CV 3650	48% Aluminum Sulfate	40% FeCl	CV 5135D	Supernatant Performance	Floc Performance
—	10,000	—	150	clear	strong/light
—	7,500	—	350	cloudy	loose
—	8,500	—	250	clear	loose
—	12,500	—	150	clear	loose
500	3,000	—	200	clear - yellow	strong/light
250	4,000	—	225	clear - yellow	strong/light
600	1,500	—	175	clear - yellow	strong/light
—	—	10,000	150	clear	poor-water
—	—	7,500	350	clear	loose
500	—	4,000	300	clear	loose
400	—	4,000	600	clear	loose

EXAMPLE 10

A jar test was performed with sludge from the thermophillic digestion process at Gulf Coast Waste Disposal Authority in Baytown, Tex. In this test, 30 ppm to 50 ppm of CV 3650 in combination with CV 5110, CV 5120, CV 5140, CV 5160 or CV 5180 at a concentration of 55 ppm to 100 ppm formed a good strong floc with a clear supernatant. Any and all polyacrylamides tried alone required in excess of 350 ppm to dewater.

EXAMPLE 11

Jar tests and plant production tests were performed on the thickener and belt press at Stroh's, in Longview, Tex.

The jar tests revealed that thickening is best accomplished with a 60:40 dosage blend of CV 3650 and CV 5250, respectively. This combination provides a performance improvement of approximately 35 percent over performance results of the polyacrylamide currently used.

The jar tests revealed that dewatering is best accomplished by a 25:75 blend of CV 3650 and CV 5250, respectively. Application of a 25:75 blend of CV 3650 and CV 5250 results in an approximately 25 to 100 percent saving over the polyacrylamide currently used. The reason for the variation is that Stroh's realizes seasonal variations in biology of its sludge. Stroh's does not apply thermophiles for digesting sludge.

EXAMPLE 12

Jar tests and plant production tests were performed on a thickener at the wastewater treatment facility at Sioux City, Ind.

Jar tests and plant production tests applied over a 6-month period revealed that a 60:40 blend of CV 5140 with CV 5400 (CV 5460.40), respectively, caused a thickening of the wasted secondary sludge at a 25 to 30 ppm concentration.

Current production at this facility requires 20 ppm to 25 ppm of a dry polyacrylamide. Due to the cost differences between the emulsion blend of CV 5460.40 and that of dry polyacrylamides, application of the emulsion blend of CV 5460.40 yields a 10 percent to 20 percent savings.

Further, the emulsion blend is 40% active in a 60% mineral oil suspension, while more than 95% of the dry polyacrylamides consists of polyacrylamide. Such dosage differences demonstrate the efficiency of this technology.

Certain objects are set forth above and made apparent from the foregoing description and examples. However, since certain changes may be made in the above description and examples without departing from the scope of the invention, it is intended that all matters contained in the foregoing description and examples shall be interpreted as illustrative only of the principles of the invention and not in a limiting sense. With respect to the above description and examples then, it is to be realized that any descriptions and examples deemed readily apparent and obvious to one skilled in the art and all equivalent relationships to those stated in the examples and described in the specification are intended to be encompassed by the present invention.

Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention. It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall in between.

What is claimed as invention is:

1. A method for dewatering biological sludge that has been digested by a thermophilic digestion process comprising:

a. adding polymeric quaternary ammonium compounds, aluminum sulfate, ferric chloride and blends thereof, as primary component, to the biological sludge; and

b. adding polyacrylamide to the biological sludge; such that any combinations of the primary component and of the polyacrylamides enhance dewatering of the sludge.

2. The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compounds are from di-allyl di-methyl ammonium chloride (DADMAC) family.

3. The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compounds are from epichlorohydrin di-methyl amine (epi-DMA) family

4. The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound, aluminum sulfate, ferric chloride and blends thereof, are added directly to the sludge and, upon formation of microfloes of the sludge from the polymeric quaternary ammonium compound, aluminum sulfate, ferric chloride and blends thereof, a cationic polyacrylamide is added to form a floc that dewaters the sludge.

5. The method for dewatering biological sludge according to claim 1, wherein ratios of the polymeric quaternary ammonium compounds with respect to aluminum sulfate range from about 1:16 to about 1:2 by weight.

6. The method for dewatering biological sludge according to claim 1, wherein ratios of the polymeric quaternary ammonium compounds with respect to ferric chloride range from about 1:8 to about 1:10 by weight.

7. The method for dewatering biological sludge according to claim 1, wherein ratios of the polyacrylamide with respect to aluminum sulfate range from about 1:80 to about 1:8 by weight.

8. The method for dewatering biological sludge according to claim 1, wherein ratios of the polyacrylamide with respect to ferric chloride range from about 1:70 to about 1:7 by weight.

9. The method for dewatering biological sludge according to claim 1, wherein polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge is between about 50 ppm:1 percent and about 300 ppm:1 percent.

10. The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound, aluminum sulfate, ferric chloride and blends thereof, are added directly to the sludge, in an amount

sufficient to cause formation of a cationic overcharge within a developed microfloc system, and an anionic polyacrylamide is then added for final floc formation.

11. The method for dewatering biological sludge according to claim 10, wherein the polymeric quaternary ammonium compound and the anionic polyacrylamide are in an approximately 1:8 to 20:1 ratio, by weight, with the anionic polyacrylamide having a higher molecular weight than the polymeric quaternary ammonium compound does.

12. The method for dewatering biological sludge according to claim 10, wherein polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of the sludge is between approximately 50 ppm:1 percent and approximately 5000 ppm:1 percent.

13. The method for dewatering biological sludge according to claim 1, wherein the biological sludge is mixed with primary sludge.

14. A composition for dewatering biological sludge according to claim 1 comprising polymeric quaternary ammonium compounds, aluminum sulfate, ferric chloride and blends thereof, as primary component, and polyacrylamide, said components being present in the composition in a ratio to enable the composition to function as an agent for dewatering biological sludge from a thermophilic digestion process.

15. The method for dewatering biological sludge according to claim 1, wherein the polymeric quaternary ammonium compounds, aluminum sulfate, ferric chloride and blends thereof, as well as the polyacrylamide, are used in solution, in emulsion or in dry form.

* * * * *